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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/705,347	11/08/2003	Catherine B. Labelle	0180151	4624

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EXAMINER	
CHEN, KIN CHAN	

ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
11/19/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/705,347	LABELLE ET AL.	
	Examiner	Art Unit	
	Kin-Chan Chen	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 September 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *21-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 21-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colombo (US 2005/0079696) in view of Alers et al. (US 6,265,260) or Tu et al. (US 6,566,250) as evidenced by Chang et al. (2004/0188240; [0040]) or Ballance et al. (US 6,090,210; col. 1, lines 32-35), or Aronowitz et al. (US 6,759,337; col. 2, lines 45-50) or Chang et al. (US 2005/0019964; [0041]).

Colombo (Fig.4; [0010] [0012] [0025] [0029][0032]) teaches conventional process steps of forming a MOS FET on a substrate comprising: A high-k dielectric layer may be formed over the substrate. A gate electrode layer (such as polysilicon) may be thereon. The gate electrode layer and high-k dielectric layer may be etched to form a gate stack (gate structure). The etching gate electrode layer and the high-k dielectric layer may be performed in a plasma processing chamber. A source /drain regions adjacent to the gate stack may be formed. Spacers may be fabricated on the sidewalls of the gate stack. Thermal anneal may be performed on the gate stack.

Colombo teaches that a nitridation process may be performed on the sidewalls of gate structure (Fig. 4, [0011][0012][0026]). Unlike the claimed invention, Colombo is silent about using nitrogen-containing plasma for nitridating sidewalls. However, Colombo teaches nitridation may be accomplished by any suitable techniques [0011]. Hence, it would have been obvious to one with ordinary skilled in the art to use the conventional nitridation method of applying plasma comprising nitrogen. Alers et al. (US 6,265,260; col. 3, lines 41-43) or Tu et al. (US 6,566,250; col.6, lines 7-9) is only relied on to show the conventional nitridation method of applying plasma comprising nitrogen. Because it is a conventional method in the art of semiconductor device fabrication and because it is disclosed by Alers, Tu, hence, it would have been obvious to one with ordinary skilled in the art to apply said nitridation method in the process of Colombo in order to efficiently carry out the nitridation process.

Since the combined prior art teaches performing same nitridation on the gate stack, it is expected that the method of the combined prior art would contain the same properties and effects (such as nitrogen forming an oxygen diffusion barrier in the high-k dielectric segment and preventing lateral diffusion of oxygen into the high-k dielectric segment).

Colombo (**[0012], last 4 lines)** also teaches that the nitridation of the sidewalls **may repair damage on the sidewalls of the high-k dielectric segment caused during the step of etching the gate electrode layer and the high-k dielectric layer,** which is same as instantly claimed.

Claims 21 and 28 differ from Colombo by specifying performing a nitridation process immediately after the step of etching the gate electrode layer and the high-k dielectric layer. However, Colombo [0026) discloses that the process steps in exemplary method in Fig, 4 may occur **in different orders.** Hence, it would have been obvious to one with ordinary skill in the art that the nitridation process may be performed

immediately after the step of etching the gate electrode layer and the high-k dielectric layer as claimed in absence of unexpected result or criticality. Furthermore, in applicant's specification (page 8, lines 2-10), applicant states that nitridation can be performed in different process chamber, after wet clean process, or immediately after the gate etching. As such, there is no unexpected result of criticality that the nitridation process be required immediately after the step of etching.

In general, the transposition of process steps or the splitting of one step (e.g., etching step) into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held to be not patentably distinguish the processes. Ex parte Rubin 128 USPQ 440.

Changes in sequence of processing steps and the selection of any order of performing process steps are prima facie obvious in the absence of new or unexpected result. Ex parte Rubin, 128 USPQ 440. See also In re Burhans, 154 F.2d 690, 69 USPQ 330.

Claims differ from prior art by specifying performing the nitridation and etching in the same process chamber. However, It is common in the art that the plasma process chamber may be used for performing both etching and nitridation because it is efficient and more cost effective. See Chang et al. (2004/0188240) or Ballance et al. (US 6,090,210), or Aronowitz et al. (US 6,759,337) or Chang et al. (US 2005/0019964) in the record as evidence.

The limitations of claims 21, 27, 28, and 34 have been addressed above and rejected for the same reasons, supra.

As to dependent claims 22-26 and 29-33, Colombo teaches various high-k dielectric materials, which read on instant claims, see [0025].

Response to Arguments

3. Applicant's arguments filed September 6, 20067 have been fully considered but they are not persuasive.

Applicant has argued that Colombo does not disclose performing a nitridation process immediately after the step of etching the gate electrode layer and the high-k dielectric layer. It is not persuasive. Colombo [0026) discloses that the process steps in exemplary method in Fig, 4 may occur **in different orders.** Hence, it would have been obvious to one with ordinary skill in the art that the nitridation process may be performed immediately after the step of etching the gate electrode layer and the high-k dielectric layer as claimed in absence of unexpected result or criticality. Furthermore, in applicant's specification (page 8, lines 2-10), applicant states that nitridation can be performed in different process chamber, after wet clean process, or immediately after the gate etching. As such, there is no unexpected result of criticality that the nitridation process be required immediately after the step of etching. See also the case law cited below.

In general, the transposition of process steps or the splitting of one step (e.g., etching step) into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held to be not patentably distinguish the processes. Ex parte Rubin 128 USPQ 440.

Changes in sequence of processing steps and the selection of any order of performing process steps are prima facie obvious in the absence of new or unexpected result. Ex parte Rubin, 128 USPQ 440. See also In re Burhans, 154 F.2d 690, 69 USPQ 330.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Chang et al. (2004/0188240; [0040]) or Ballance et al. (US 6,090,210; col. 1, lines 32-35), or Aronowitz et al. (US 6,759,337; col. 2, lines 45-50) or Chang et al. (US 2005/0019964; [0041]) teaches that the plasma process chamber may be used for performing both etching and nitridation.

5. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

November 15, 2007

KIN-CHAN CHEN
PRIMARY EXAMINER
AU 1792